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Analysis of Impact of Rural Electrification on Agro-based and Non-agro based Enterprises in Riverside Rural Communities in Cross River State, Nigeria

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Abstract:
The study analyzed the impact of rural electrification project on agro-based and non-agro based enterprises in riverside rural communities in Cross River State, Nigeria. Data were obtained from 160 respondents for socio-economic assessment, 12 operators of multi-purpose grating mills and 26 operators of barbing salons. Net enterprise income, percentage change in income, difference in difference and paired t-test were used for the data analysis. The results of the research revealed that the total income and net enterprise income of operators of agro-based and non-agro based enterprises with electricity increased significantly after electricity intervention and also more than that of operators in riverside rural communities without electricity. Difference in difference and paired t-test were significant at 0.05 percent. This implied that there was an impact of electricity on the income of operators of agro-based and non-agro based enterprises in the study area. It was recommended that government should intensify action in providing riverside rural communities with electricity as this is one of the veritable tools for rural transformation.

Keywords: *Riverside rural communities, electricity, socio-economic variables, agro-based and non-agro based enterprises*

1. Introduction

The concern for rapid sustainable rural development has been the major focal point of most government policies in Nigeria, especially in the post-colonial era. Each successive regime had made its own attempts by devising or adopting one approach or the other to implement its development polices. Some of these programmes were successful, others did not achieve their desired objectives, thus leading to their inability to sustainably eliminate rural poverty and underdevelopment. Rural development generally refers to the process of improving the quality of life and economic well-being of people living in relatively isolated and sparely populated areas (Ekong, 2008;Ijere, 1992). The definition of rural development varies from one point of view to the other. The definition or rural development may be centered around income criterion which the concept is made to address the problem of rural poverty.It may be defined in sociological concept in which the rural poor represents a reservoir or untapped talent, a target group that should be given the opportunity to enjoy the benefits of development through improved education, health, nutrition as well as provision of portable water, rural access roads and rural electricity. This is because the provision of social infrastructures could provide the catalyst that would transform the rural areas.

Conscious of the pivotal economic role electricity plays in the enhancement of the economics of riverside rural communities Cross River State using the State Electrification Agency (SEA) as the vehicle for implementation, has so far provided electricity to 176 rural communities, raising the population of people in the state with access to electricity to 80 percent (CRSEA,2013).Several pieces of evidence suggest that household electrification in South Africa raises employment by releasing women from home production and enabling micro enterprises (Dinkelman, 2010; Posel and Daniela, 2004).Concerned about the low standard of living in many developing countries, in 2000, the United Nations established the Millennium Development Goals (MDGs) and set target to improve the standard of living of the world's poor (UN, 2000). For example, to achieve universal primary education, electricity is needed for good lighting for reading in homes and to power some teaching aids; to reduce child mortality and improve maternal health, electricity is needed in health facilities to power refrigerator for preserving drugs and vaccines, etc.

Studies have shown that there is a high correlation between the level of electricity consumption and human development index (Meisen and Akin, 2008). Several other studies have been carried out on the impact of access to electricity on small and micro-scale enterprises in developing countries (Little, 1987; Akpan, *et al.*; 2013). Little (1987) investigated the role of small and micro-enterprises in fostering economic growth and underscore the importance of electricity access as a basic ingredient of firm development. Akpan *et al*. (2013), found that although not statistically significant on average, enterprises in communities connected to

the electricity grid are 16.2 percent more profitable than enterprise in communities not connected to the grid and the use of generating sets in providing back-up electricity makes micro-enterprises more profitable.

However, Neelsen and Peter (2011), assessed the impact of electricity access in micro-enterprises in Uganda using quantitative firm-level data from 200 enterprises complements by quantitative case studies.The study found out that there was little direct impact of electricity access on firm profits or worker remuneration, while there was significant indirect effect mainly due to increase in demand for goods and services prompted by migration from non- electrified communities. Some rural communities have been electrified in conjunction with other rural infrastructures provided to transform the rural communities in Cross River State. All the intervention from these agencies do not seem to have yielded desirable results as the rural population remain poor, malnourished and still faced with low agricultural productivity, high infant mortality rate as well as rural income which are lower than twenty years ago (Neumayer, 2001).

Human development indicators such as income, equality and rural environmental quality, etc; have not been too encouraging while rural infrastructural projects like electricity in rural areas lack far behind that of their urban counterparts (Neumayer,2001).

The main purpose of this study is to analyze the impact of rural electrification on agro-based and non-agro based enterprises in riverside rural communities in Cross River State, Nigeria. Specific objectives of the study included the assessment of the socio-economic variables

of rural dwellers in riverside rural communities with electricity and those without, identification of agro-based and non-ago based enterprises, analyze the impact of rural electricity on income of operators of agro-based and non-agro based enterpriseswith electricity and those without.

This study is propelled by the desire to ascertain the impact of electrification project on riverside rural dwellers in Cross River State. Apart from adding to the existing literature on the development of riverside rural communities in the state and the country as a whole, it will help policy makers to determine the effectiveness of rural electrification projects in the area with a view to redirecting and reinforcing electrification projects for optimal performance in riverside rural communities and the country as a whole.

2. Methodology

2.1. Description of the Study Area

Cross River State is one of the 36 states of the Federal Republic of Nigeria. It is made up of 18 Local Government Areas and consists of 3 Agricultural Zones namely, Calabar, Ikom and Ogoja agricultural zones. According to the National Population Census conducted in 2006, the State has an estimated population of 2888,966 persons (National Population Commission, 2006).The State is located in the Niger Delta Region of Nigeria, and bounded in the North by Benue State, in the South by Akwa Ibom and the Atlantic Ocean, in the East by Cameroon Republic, West by Ebonyi and Abia States. Cross River Statelies within longitude $7^0\ 50^1$ and $9^0\ 28^1$ East of the Greenwich Meridian and Latitude of $5^0\ 32^1$ and $4^0\ 27^1$, North of the equator (Cross River State Ministry of Lands and Surveys, 2010). The major Rivers in State are the Cross River, Aya River, Kwa River, Akpa Yafe River and Calabar River. The Cross River which takes off from the Republic of Cameroon passing through the State and empties into the Atlantic Ocean. The Cross River flows through Etung, Ikom, Obubra, Yakurr, Abi, Biase and Odukpani Local Government Areas. The Aya River flows through Yala, Ogoja and Ikom Local Government Areas and empties into the Cross River.

The Kwa River flows through Odukpani, while Akpa Yafe River flows through Akpabuyo and Bakassi Local Government Areas and empties into the Atlantic Ocean. The Calabar River flows into Cross River. For this study the River of interest is the Cross River with its surrounding communities These are rural communities located along the River and those that are within the range of 5 kilometres from the river.

The area is characterized by two distinctive seasons- the dry which last from November to the middle of April and the wet which starts from the middle of April to October. The riverside rural communities are endowed with abundant swamp suitable for swamp rice cultivation and dry season farming especially of vegetables. The rural riverside dwellers are engaged in farming, fishing, hunting, tailoring, carpentry, post-harvest processing, etc. The major crops grown include yams, cassava, cocoyam, maize, rice, vegetable, citrus, bush mango, oil palm, cocoa, etc. livestock such as poultry, sheep, goats, etc are kept in all riverside rural communities which survive by scavenging around the homestead and nearby bush.

The riverside rural communitiesfor the study consists of all rural communities along the Cross River and those within a range of 5 kilometres away from the river. This is made up of 78 riverside rural communities with a total population of 511, 604 persons (NPC, 2006).

2.2. Sources and Methods of Data Collection

Data for this study were obtained from primary and secondary sources. The primary data were obtained through the use of structured interview schedules administered on 160 respondents, 12 operators of agro-based and 26 operators of non-agro based enterprises. For example, data on age, sex, income level of education, membership of local organizations, etc were obtained from the respondents' responses to questions during the interview. Secondary data were obtained from reports, publications, list of communities that benefited from electrification project obtained from the Cross River State Electrification Agency.

A multi-stage sampling method was adopted in the selection of River Cross River, riverside rural communities and 160 respondents, 12 operators agro-based enterprises (Multipurpose grating mills) and 26 non-agro based enterprises (Barbing salons).

Eighty respondents were selected from eight riverside rural communities that benefited from electrification project and the same number from eight riverside communities with electricity project. This gave a total of 160 respondents. Six multipurpose grating mills with electricity from the national grid were selected from benefiting riverside rural communities and 6 from riverside rural communities without electricity from national grid. The approach was adopted in the selection barbing salons. 13 barbing salons with electricity from national grid and the remaining 13 are without electricity from national grid.

2.3. Analytical Framework

Data collected were analyzed using descriptive statistics, net enterprise income, difference in difference and paired t-test approaches. Simple descriptive tools such as mean and percentages were adopted to formulate descriptive analyses for socio-economic data. Net enterprise income (NEI) method was used to evaluate and compared the income of operators of multi- purpose grating mills and barbing salons with electricity and those without.

The specification for the net enterprise income is as follows:

NEI = TEI - (TVC + TFC)

Where

NEI = Net Enterprise Income

TEI = Total Enterprise Income

TVC = Total Variable Cost (Plugs, Fuel, Cost of Servicing)

TFC = Total Fixed Cost

(Mill stand, multi-purpose grating mill, electric motor. Using depreciation).

Therefore,

$$\% \text{ change in income} = \frac{\text{Income after- Income before}}{\text{Income before}} \times 100$$

Using difference in difference involved selection of operators with electricity from national grid (Beneficiaries) and operators without electricity from national grid(Non-beneficiaries) from the same location who have similar characteristics but differs in one aspect which in this case is the electricity (Baker,2000; Chen, *et al.,* 2006). The difference in difference is defined as the difference in mean outcome in the non-benefiting group before and after electricity intervention. It is literally a "difference of differences" (Nkonya, *et al.,*2008; Verner and Verner, 2005).The advantage of using the difference in difference is that its met out the effects of additive factors that have fixed (time-invariant) impacts on income indication, or project beneficiaries (Ravallion, 2005).

Difference in difference can be looked at in three different ways; these are in a box, graphically and in a regression forms. Using the in box difference in difference is shown

$$DD=\sum [Y_1^t] - \sum [Y_0^t] - ([\sum [Y_1^c] - \sum [Y_0^c])]$$

Where

DD = Difference in difference, which is the outcome difference between operators with electricity and operators without electricity

$\sum$= Summation sign

$[Y_1^t]$ = Mean income variable of operators with electricity after electricity intervention

$[Y_0^t]$ = Mean income variable of operators with electricity before electricity intervention

$[Y_1^c]$ = Mean income variable of operators without electricity after electricity intervention

$[Y_0^c]$ = Mean income variable of operators without electricity before electricity

intervention (Card & Krueger, 1994; Simonyan and Omolehin, 2012).

A positive and significant income difference value implied electricity intervention impact on the operators with electricity otherwise no impact.

The level of significance of the mean income disparity was tested using paired t- test at 0.05 percent level of significance. If the estimated t-value is higher than the table value implied electricity intervention impact on the operators of agro-based and non-agro based enterprises with electricity. The model specification for the Paired t-test is as follows:

$$t = \frac{\overline{X_1} - \overline{X_2}}{\sqrt{\frac{S_1^2}{n_1} + \frac{S_2^2}{n_2}}}$$

$n_1 + n_2 - 2$ = degree of freedom

Where

t = t – test statistics

$\overline{X_1}$ = Mean income difference of operators with electricity before and after electricity intervention as group 1

$\overline{X_2}$ = Mean income difference of operators without electricity before and after electricity intervention as group 2

S_1^2 = Variance of group 1

S_2^2

S = Variance group 2
n_1 = Total number of operators in group 1
n_2 = Total numberof operators in group 2

3. Results and Discussion

3.1. Socio-Economic Characteristics of Respondents

Table 1 shows the selected socio-economic characteristics of respondents that benefited, and those that are yet to benefit from rural electrification project. The selected socio-economic variables are sex, age, educational status, major occupation, marital status and their estimated annual income. With respect to sex, it can be seen that the male constitute 61.25% and 57.50% in the benefiting and non-benefiting riverside rural communities respectively. The age range of the respondents varied, 37.50% are between 46-55years of age in benefiting riverside rural communities, while it is 37.50% for respondents of age range between 26-35years of age for non-benefiting riverside rural communities. Implying that, in the study area, majority of the respondents are within the active and energetic middle ages of production. The mean ages of the two categories of communities are close which is 48.35 and 44.25 for benefiting and non-benefiting communities respectively. The educational status of the riverside rural dwellers revealed that, high percentage of them have formal education, an observation which tends to disprove the purported rate of illiteracy common in rural communities in Nigeria. The possible reason for this outcome is that, the Cross River was the major entry point for the early Scottish missionaries into the inter-land of Cross River State spreading Christianity and western education and therefore afforded the riverside rural dwellers the opportunity for early western education that is likely handed down to subsequent generations. This is further explained by the total number of mission schools in the study area.

The inference from this is that, education attainment is expected to affect positively the productivity of riverside rural dwellers as educated respondents who are farmers are more likely to adopt modern agricultural practices (Binswanger,1989). Sixty percent of the respondents in the benefitting communities practiced farming as their major occupation, while is 52.50% for respondents in non-benefitting communities. Married respondents accounted for 80% and 87.50% for riverside rural communities with electricity and those without respectively. The dominant family size (60%) was in the range of between 1 - 4 persons in riverside rural communities with electricity, 1 - 4 persons accounted for 52.50% for communities without electricity. The mean family size is the same for the two categories of communities with 4 persons.

Riverside rural communities with electricity from the sampled respondents have mean income of N139, 637.50, while for those without electricity was N113, 125.00. In terms of membership of local organizations, majority of the respondents from the two categories of riverside rural communities are members of local organizations available in the study area with preference for farmers' cooperatives.

Sex	Benefiting		Non-benefitting	
	Frequency	Percentage	Frequency	Percentage
Male	49	61.25	46	57.50
Female	31	38.75	34	42.50
Total	80	100	80	100
Age				
16-25years	1	1.25	1	1.25
26-35	10	12.50	30	37.50
36-45	20	25.00	21	26.25
46-55	30	37.50	6	7.50
56-65	11	13.75	10	12.50
66-75	8	10.00	12	15.00
Total	80	100	80	100
Mean	48.35		44.25	
Educational Status				
Non formal Ed.	8	10.00	10	12.50
F.S.L.C	32	40.00	30	37.50
J.S.S.C	4	5.00	2	2.50
SSSC/WAEC/NECO	30	37.50	30	37.50
OND	2	2.50	6	7.50
HND/B.Sc	3	3.75	2	2.50
PGD	1	1.25	0	0
Total	80	100	80	100
Major Occupation				
Farming	48	60.00	42	52.50
Hunting	6	7.50	10	12.50
Fishing	22	27.50	20	25.00
Civil Service	2	2.50	4	5.00
Trading	2	2.50	4	5.00
Total	80	100	80	100
Marital Status				
Married	64	80.00	70	87.50
Single	10	12.50	6	7.50
Divorced	2	2.50	1	1.25
Widowed	4	5.00	3	3.75
Total	80	100	80	100
Family size				
1-4	48	60.00	42	52.50
5-8	30	37.50	38	47.50
9-12	2	2.50	0	0.00
Total	80	100	80	100
Mean	4.20		4.40	
Estimated Annual Income				
Less than ₦100,000	36	45.00	45	56.52
₦101,000-₦ 201,000	28	35.00	25	31.25
₦202,000-₦ 302,000	8	10.00	6	7.50
₦303,000-₦403,000	5	6.25	3	3.75
₦404,000-₦504,000	3	3.75	1	1.25
Total	80	100	80	100
Mean	₦139, 637.50		₦113, 125.00	
Membership of local organizations				
Farmers' cooperative	30	42.86	20	35.71
Social clubs	5	7.14	10	17.86
Market unions	15	21.43	12	21.43
Age Group	20	28.57	14	25.00
Total	70	100	56	100

Table 1: Distribution of Selected Socio-economic Characteristics of Respondents in Riverside Rural Communities with Electricity and those without

Source: Estimated from field data, 2015

3.2. Agro-based and Non-agro based Enterprises

Table 2 shows the distribution of identified agro-based and non-agro-based enterprises in the study area. Table 2 reveals that, 34 agro-based and 65 non-agro based enterprises were identified in the study area. The agro-based enterprises identified were rice processing mills, oil palm processing mills, cassava processing mills and multi-purpose grating mills, while non-agro based enterprises identified were barbing salons, welding, provision stores, ice cream making and tailoring.

The distribution shows that, 41.17 percent of the agro-based enterprises in riverside rural communities with electricity were multi-purpose grating mills; this was followed by rice processing mills with 23.53 percent. Oil palm processing mills recorded 20.59 percent while 14.71 percent were cassava processing mills. In riverside rural communities without electricity, 33.33 percent of the agro-based enterprises identified were multi-purpose grating mills, Oil palm processing mills and cassava processing mills recorded 27.78 percent each.

Rice processing mills recorded 11.11 percent of the total number of agro-based enterprises identified in riverside rural communities without electricity. Also in table 2 is the distribution of non-agro based enterprises in the study area. In riverside rural communities with electricity, out of 65 non-agro based enterprises identified, 44.62 percent were provision stores, 35.38 percent were barbing salons, while 9.23 percent were tailoring enterprise. For the riverside rural communities without electricity, 32 non-agro based enterprises were identified. From table 2, 40.63 percent were barbing salons, 27.12 percent were provision stores, 18.75 percent were welding enterprise while ice cream making and tailoring recorded 6.25 percent each. From the outcome it can be concluded that riverside rural communities with electricity in the study area attracted more presence of agro-based and non-agro based enterprises than riverside rural communities without electricity.

S/no Enterprises	Riverside rural communities With electricity		Riverside rural communities without electricity	
	Frequency	Percentage	Frequency	Percentage
i. Agro-based Enterprise				
Rice processing mill	8	23.53	2	11.11
Oil palm processing mill	7	20.59	5	27.78
Cassava processing mill	5	14.71	5	27.78
Multi-purpose grating mill	14	41.17	6	33.33
Total	34	100	18	100
ii. Non-agro based enterprise				
Barbing salon	23	35.38	13	40.63
Welding	4	6.15	6	18.75
Provision store	29	44.62	9	27.12
Ice cream making	3	4.62	2	6.25
Tailoring	6	9.23	2	6.25
Total	65	100	32	100

Table 2: Distribution of Agro-based and Non-agro based Enterprises
Source: Estimated from field data, 2015.

3.3 Net Enterprise Income, Difference in difference Estimates of Operators of Agro-based Enterprise (Multi-purpose grating mills).

Table 3 shows that the net enterprise income of operators of multipurpose grating mills before electricity was ₦702,692.37 while after electricity connection from the national grid the net enterprise income was ₦1,340,531.99.The percentage change in total income before and after connection to the national grid was 44%. This mean that the total income increase at 44% after intervention for the operators with electricity. For the operators of multipurpose grating mills without electricity from national grid the net enterprise income before intervention was ₦626,653.70, while after intervention the net enterprise income was ₦728,744.29. However, the percentage change in total income for operator of multipurpose mills without electricity from national grid before and after intervention was 7%.The results indicate an increase in the total income of operatorsof multi-purpose grating mills with electricity was higher (44%) than those of the operators without electricity (7%).

The higher difference in net enterprise income and total income of operators with electricity over that of operators without electricity was attributed to electricity intervention from the national grid.

Input	Operators with electricity		Operators without electricity	
	Before	After	Before	After
A				
Variable cost(₦)				
Fueling	180,800.12	70,400.49	250,480.50	230,500.15
PHCN bill	-	90,000.00	-	-
Labour	288,105.40	209,405.80	261,400.40	254,000.28
Plug	10,040.20	4,100.69	15,810.24	15,950.14
Servicing	15,840.10	16,960.18	18,240.19	18,390.17
Total 1	4,94,805.82	390,867.16	545,931.33	5,18,840.74
B				
Fixed Cost (₦)				
Bucket	240.16	240.16	254,28	254.28
Electric Motor	6,060.49	6,060.49	6,060.49	6,060.49
Mill stand	1,201.16	1,100.20	1,100.20	1,100.20
MGM	15,000.00	15,000.00	15,000.00	15,000.00
Total 2	22,501.81	22,400.85	22,414.97	22,414.97
C				
Total Income (₦)	1,220,000.00	1,753,800.00	1,195,000.00	1,270,000.00
D				
Net enterprise Income (₦) = C- (A+B)	702,692.37	1,340,531.99	626,653.70	728,744.29
E				
Percentage change in Total Income		44%		7%

Table 3: Net enterprise Income of Agro-based Enterprise (Multipurpose grating mills)
Source: Estimated from field data, 2015.

Table 4 shows the difference in difference estimates of mean income of operators multipurpose grating mills before and after project intervention (electricity). The estimation revealed that, difference in difference in mean annual income between operators of multi-purpose grating mills with electricity and those that are in riverside rural communities yet to benefit from rural electrification was ₦76,466.67. However, the mean income difference for operators with electricity before and after interventions was ₦88,966.67, while that of operators without electricity from the national grid was ₦12,500.00.

The higher difference in the mean income of operators with electricity in benefiting riverside rural communities over that of the operators without electricity in non-benefiting riverside rural communities can be accredited to the usage of electricity. The positive and significant difference implies electricity impact on the beneficiaries (operators with electricity from national grid).This shows that electricity is one of the variables that contribute to the increase mean income of operators of multi-purpose grating mills with electricity. This implies that the operators of multi-purpose grating mills that uses electricity in operating their mills rather than generators that demand the purchase of petrol or diesel spend less in their operational cost and therefore more likely to earn a higher income thereby making more profit. With electricity one can easily run a small business in rural areas efficiently. The outcome of the analysis is similar to research outcomes that, electricity allows for mechanization of many farming and non-farming operations for greater productivity at reduced cost (Dinkelman, 2010; Barnes *et al.,* 2009).

	Total income		Mean			
Variable	After	Before	After	Before	MD	DD
Operators of multi-purpose Grating mills with Electricity	1,753,800	1,220,000	292,300	203,333.33	88,966.67	76,466.67
Operators of multi-purpose Grating mills without Electricity	1,270,000	1,195,000	211,666.67	199,166.67	12,500.00	

Table 4: Difference in difference Estimates of Impact of Electricity on Agro-based Enterprise (Multi-purpose grating mills) Income before and after Intervention
Source: Estimated from field data, 2015.

The level of significance of the mean income diversity between operators of multipurpose grating mills with and those without electricity was tested by applying paired t-test and the result is presented in Table 5. Table 5 reveals the difference in mean income of operators of multi-purpose grating mills (agro-based enterprise) with electricity and those without electricity before and after electricity intervention. The difference in mean income of operators of multi-purpose grating mills with electricity was N88,966.67 with variance of 391,969,954.96, while that of operators without electricity was N12,500.00 with variance of 257,500,000.00.The calculated t-value of 7.35 was far bigger than the critical t-value of 1.812 at 0.05 percent level of significance with 10 degrees of freedom. With this outcome, its means that the incomes of the operators of multi-purpose grating mills with electricity are significantly difference from the incomes of operators of multi-purpose grating mills without electricity.

Variable	Mean difference	DD	S^2	t-cal
Operators of multi-purpose Grating mills with rural Electricity	88,966.67	-	391,969,954.96	
		76,466.67		7.35
Operators of multi-purpose Grating mills without Rural electricity	12.500	-	257,500,000	

Table 5: Result of Paired t-test Analysis of Difference in Mean Income of Agro-based Enterprise (Multi-purpose grating mills) Income
Source: Estimated from field data, 2015
df = 10, table t-value = 1.812 at 0.05 level of significance, DD = difference in difference mean.

3.4. Net Enterprise Income of Operators of Non-agro based Enterprise (Barbing salons)

Table 6 shows the impact of electricity on the total income, net enterprise income and percentage change in total income. The total income of operators of barbing salons before intervention were₦4,610,800.00 and ₦3,852, 400.00 for operators with electricity and those without electricity respectively. After intervention their total income was ₦5,867,030.00 and ₦4,600,650.00 for operators with electricity and those without respectively. The net enterprise income before intervention was ₦2,045,426.48 and ₦2,278,156.84 for operators with electricity and those without respectively, while after intervention the net enterprise income was ₦3,225,614.84 and N3,123,978.23 for operators with electricity and those without respectively. After intervention the net enterprise income was N3,225,614.84 and ₦3,128,978.23 for operators with electricity and those without electricity respectively. The results also indicate increase in total income and net enterprise income for the two groups, but the increase in total income for operators with electricity from national grid was higher (28%) than that of operators without electricity from national grid (20%).

Inputs	Operators with electricity		Operators without electricity	
	Before	After	Before	After
A				
Variable cost (₦)				
Fueling	200,510.15	80,090.17	210,480.60	209,501.70
PHCN Bill	-	91,481.50	-	-
Labour	2,240,000.10	2,340,760.18	1,302,000.04	1,201,000.50
Servicing	50,480.55	50,670.40	30,403.50	29,480.30
Detergents/sterilizers fluid	60,780.01	64,810.20	20,480.26	20,810.50
Total 1	2,551,770.81	2,627,812.45	1,563,364.40	1,460,793.00
B				
Fixed Cost (₦)				
Clipper	3,900.00	3,900.00	2,941.5	2,941.50
Mirror	1,820.00	1,820.00	1,690.48	1,690.48
Electric Fan	3,400.26	3,400.26	2,814.80	2.814.80
Chairs	2,041.50	2, 041.50	1,870.69	1,870.69
Sterilizing machine	1,600.25	1,600.25	940.40	940.40
Apron/brushes	840.70	840.70	620.89	620.89
Total 2	13,602.71	13,602.71	10,878.76	10,878.76
C				
Total Income (₦)	4,610,800.00	5,867,030.00	3,852,400.00	4,600,650.00
D				
Net enterprise Income (₦)=C -(A+B)	2,045,426.48	3,225,614.84	2,278,156.84	3,128,978.28
E				
Percentage change in Total Income	28%	20%		

Table 6: Net enterprise Income of Non-agro-based Enterprise (Barbing salons)

Source: Estimated from field data, 2015.

Table 7 shows difference in difference estimates of mean annual income of operators of barbing salons before and after project intervention (electricity) reveals that, difference in difference in mean annual income between operators of barbing salons with electricity and those without electricity was N39,075.39. However, the mean income difference for operators of barbing salons with electricity before and after intervention was N96,633.08, while that of operators that are without electricity before and after was N57,557.69.

The higher difference in the mean annual income of operators of barbing salons with electricity in benefiting riverside rural communities over that of the operators of barbing salons without electricity in non-benefiting riverside rural communities can be attributed to the usage of electricity. The difference in difference was positive and significant. This implies electricity impact on the beneficiaries. This shows that electricity is one of the variables that can influence income of operators of barbing salons.

Variable	Total income After	Total income Before	Mean After	Mean Before	MD	DD
Operators of barbing Salons with Electricity	5,867,030	4,610,800	451,310	354,676.9	96.633.08	39,076.39
Operators of barging Salons without Electricity	4,600,650	3,852,400	353.896.15	296,338.46	57,557.69	

Table 7: Result of Difference in difference Estimates of Impact of Electricity on Non-Agro based Enterprise (Barbing salons) Income
Source: Estimated from field data, 2015
DD = Difference in difference mean income is positive
MD = Mean difference

The level of significance of the mean income dissimilarity was tested by applying paired t-test. The result of the paired t-test as shown in Table 8 reveals a mean annual income difference of N96,633.08 and N57,557.89 for operators with electricity and those without electricity respectively. The paired t-test analysis revealed t-calculated value of 3.59 greater than table or critical value of 1.711. Given the fact that percentage change in the total income of the two categories of operators with electricity were all greater than the other two categories of operators without electricity (multi-purpose grating mills and barbing salons) and were positive, the difference in difference estimates were all positive and significant as well as the paired t-test with t-calculated values greater than the critical values, and significant at 0.05 percent level of significance, this mean that electricity is one of the variables that can influence income of operators of multi-purpose grating mills and barbing salons in riverside rural communities.

Variable	Mean difference	DD	S^2	t-cal
Operators of barbing Salons with rural Electricity	96,633.08		1,188,999,478.91	
		39,075.39		3.59
Operators of barbing Salons without rural Electricity	57,557.69		50,608,323.70	

Table 8: Result of Paired t-test Analysis of the Difference in Mean Income of Non-agro based Enterprise (Barbing salons)
Source: Estimated from field data, 2015
df = 24, table t-value = 1.711 at 0.05 level of significance
DD = Difference in difference.

4. Conclusion and Recommendations

From the study, it can be concluded that electricity contributed to increase the income of operators of agro based (multi-purpose grating mills) and non-agro based (barbing salons) enterprises significantly after electricity intervention. This is evidence from the percentage change in total income of operators with electricity more than operators without electricity.

Difference in difference result, further proved the fact that the increase in income realized by the operators with electricity was attributed to their utilization of electricity from the national grid. The paired t-test analyses were all significant meaning that, electricity impacted on the operators of agro-based and non-agro based enterprises with electricity from national grid in the study area.

The following recommendations follow from the study:

- There is greater need for the government of Cross River State to intensify action in providing riverside rural communities with electricity as this is one of the veritable tools for rural transformation.
- Government should create awareness relating to electricity areas of further utilization. For example, electricity is usually used for households lighting, however, it can also be used in other areas like ice making.
- Credit facilities of low interest rates without collateral security be made available to riverside rural dwellers to diversified into areas of electricity utilization. This is necessary because electricity utilization is free and only riverside rural dwellers with the required finances can be connected.

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